GUREVICH, A.N., kand.tekhn.nauk, SINENKO, N.P., inzh., SIMSON, A.E., kand.tekhn.nauk

Improving the performance of idling 2D100 diesel locomotives. Vest.TSNII MPS 19 no.2:20-24 '60. (MIRA 13:6)
(Diesel locomotives)

SHISHKIN, Kirill Aleksandrovich, prof. [deceased]; GUREVICH, Abram Natanovich, kand. tekhn. nauk; STEPANOV, Aleksandr Dmitriyevich, doktor tekhn. nauk; VASIL'YEV, Vladimir Andreyevich, inzh.; SURZHIN, Sergey Nikolayevich, inzh.; KAMENETSKIY, B.G., kand. tekhn. nauk, retsenzent; MOISEYEV, G.A., inzh., retsenzent; TURIK, N.A., inzh., retsenzent; SAZONOV, A.G., inzh., red.; KHUTORYANSKIY, N.M., kand. tekhn. nauk, red.; KHITROV, P.A., tekhn. red.

[TE3 diesel locomotive] Teplovoz TE3. Izd.2., perer. Moskva, Vses. izdatel'sko-poligr. ob"edinenie M-va putei soobshcheniia, 1961. 371 p. (MIRA 14:6)

(Diesel locomotives)

SHISHKIN, Kirill Aleksandrovich, zasl. deyatel' nauki i tekhniki, prof. [deceased]; GUREVICH, Abram Natanovich, kand. tekhn. nauk; STEPANOV, Aleksandr Dmitriyevich, kand. tekhn. nauk; PLATONOV, Yevgeniy Veniaminovich, kand. tekhn. nauk; BLIZNYANSKIY, Aleksandr Semenovich, inzh.; PIRIN, I.V., kand. tekhn. nauk, retsenzent; BASENTSYAN, A.A., inzh., red.izd-va; MODEL', B.I., tekhn. red.

[Soviet diesel locomotives] Sovetskie teplovozy. Izd. 4., perer. i dop. Moskva, Gos. nauchno-tekhn. izd-vo mashinostroit. lit-ry Mashgiz, 1961. 480 p. (MIRA 14:9)
(Diesel locomotives)

STRUNGE, Boris Nikolayevich; MUL'MAN, Boris Yefimovich; EPSHTEYN, Abram Semenovich; GUREVICH, A.N., kand. tekhn. nauk, retsenzent; SMIRNOVA, V.L., red. izd-va; EL'KIND, V.D., tekhn. red.

[Design of locomotive and marine engines abroad] Konstruktsii zarubezhnykh teplovoznykh i sudovykh dvigatelei. Moskva, Gos. nauchno-tekhn. izd-vo mashinostroit. lit-ry, 1961. 299 p. (MIRA 14:11)

(Diesel locomotives) (Marine diesel engines)

BELOUSOV, I.A., mashinist teplovoza; FOKIN, M.D., kand.tekhn.nauk; ILYUKHIN, A.A., mashinist-instruktor; GUREVICH, A.N., kand.tekhn. nauk.

Reply to the inquiries of our readers. Elek. i tepl. tiaga no.1:42-43 Ja '61. (MIRA 14:3)

1. Depo Kazalinsk Kazakhskoy dorogi (for Belousov). 2. Depo Krasnoufimsk Kazanskoy dorogi (for Ilyukhin).
(Railroads--Brakes)

GUREVICH, A.[illegible], kand.tekhn.nauk

Inspection and regulation of fuel systems. Elek.i tepl.tiaga 6 no.2:36-39 F '[illegible] (MIRA 15:2)
(Diesel engines--Fuel systems)

GUREVICH, A.N., kand.tekhn.nauk

Fuel pump control mechanism. Elek.i tepl. tiaga 5 no.12:33-35 D '61. (MIRA 15:1)

(Diesel engines—Fuel systems)

DUBROVSKIY, Z.M., inzh.; GUREVICH, A.N., kand.tekhn.nauk; KHATSKELEVICH, M.N., inzh.

Replies to the inquiries of our readers. Elek. i tepl. tiaga 6 no.11:42-43 N '62. (MIRA 16:1)
(Electric locomotives) (Diesel locomotives)

GUREVICH, A.N., kand.tekhn.nauk; FEDOTOV, G.B., inzh.

Studying the fuel injection process in locomotive diesel engines.
Vest. TSNII MPS 20 no.5:23-27 '62. (MIRA 15:8)
(Diesel engines--Fuel systems)

GUREVICH, A.N.; SURZHENKO, Z.I.; KLEPACH, P.T.; RUSINOV, R.V., kand. tekhn. nauk, retsenzent; GALANOVA, M.S., inzh., red.; UVAROVA, A.F., tekhn. red.

[Fuel system on diesel locomotives and motorships with D100 and D50 engines] Toplivnaia apparatura teplovoznykh i sudovykh dvigatelei tipa D100 i D50. Moskva, Mashgiz, 1963. 203 p. (MIRA 16:5)

(Diesel locomotives--Fuel system)
(Motorships--Fuel system)

GUREVICH, A.N., kand.tekhn.nauk

Torque vibrations of diesel shafts. Elek. i tepl.tiaga no.8:37-39 Ag '63. (MIRA 16:9)

(Diesel locomotives--Vibration)

GUREVICH, A.N., kand.tekhn.nauk; FEDOTOV, G.B., inzh.

Characteristics of the performance of the fuel system of the type D100 diesel engine. Trudy TSNII MPS no.262:41-52 '63. (MIRA 16:10)

YEGOROVA, K.I.; GUREVICH, A.N.

Photometric determination of rhenium in titanium alloys with 8-mercaptoquinoline. Zav.lab. 29 no.7:789-791 '63. (MIRA 16:8)
(Rhenium-titanium alloys--Analysis) (Quinolinethiol)

GUREVICH, A.N., kand.tekhn.nauk; FEDOTOV, G.B., inzh.

Ways to lengthen the service life of fuel systems. Elek. i tepl.tiaga 6 no.8:38-41 Ag '62. (MIRA 17:3)

GUREVICH, A.N., kand. tekhn. nauk; MOISEYEV, G.A., inzh., retsenzent; KISELEVA, N.P., inzh., red.; BOBROVA, Ye.N., tekhn. red.

[Fuel systems of diesel locomotive engines] Toplivnaia apparatura teplovoznykh dizelei. Moskva, Transzheldorizdat, 1963. 81 p. (MIRA 17:1)

SHISHKIN, Kirill Aleksandrovich, prof.; GUREVICH, Abram Natanovich, kand. tekhn. nauk; STEPANOV, Aleksandr Dmitriyevich, doktor tekhn. nauk; VASIL'YEV, Vladimir Andreyevich, kand. tekhn. nauk; SURZHIN, Sergey Nikolayevich, inzh.; KISELEVA, N.P., red.

["TE3" diesel locomotive] Teplovoz TE3. Izd.3., perer. [By] K.A.Shishkin i dr. Moskva, Transport, 1965. 411 p. (MIRA 18:7)

GUREVICH, A.N., kand. tekhn. nauk; FEDOTOV, G.B., inzh.

Effect of the mounting of fuel pumps and cam shafts on the performance of the 2D100 diesel locomotive engine. Elek. i tepl. tiaga 9 no.11:34-36 N '65. (MIRA 19:1)

FUFRYANSKIY, N.A., doktor tekhn. nauk; GUREVICH, A.N., kand. tekhn. nauk; YEGUNOV, P.M., kand. tekhn. nauk; POPOV, G.V., kand. tekhn. nauk; STROMSKIY, P.P., kand. tekhn. nauk

Results of traction and heat engine tests of series TG102 diesel locomotives. Vest. TSNII MPS 25 no.1:16-23 '66. (MIRA 19:2)

GURMVICH, A.O.; KUZNETSOVA, Ye.Ye. kandidat meditsinskikh nauk; RUMELIS, I.L. ; YURUSHA, A.K.

Effects of phthivazid therapy under ambulatory conditions. Probl. tub. no.6:21-26 N-D '55. (MLRA 9:2)

1. Iz Respublikanskogo protivotuberkuleznogo dispansera v Rige (glavnyy vrach Ye. Ye. Kuznetsova)

(TUBERCULOSIS, ther.
isoniazid, under ambulatory conditions)
(NICOTINIC ACID ISOMERS, ther. use
isoniazid, in tuberc., under ambulatory conditions)

Gurevich, A.O.

GUREVICH, A.O., kand.med.nauk; VESTERMAN, Ye.S.; PORTSIAKHOVA, A.K.

Pathogenesis and clinical aspects of tuberculosis in adolescents. Pediatriia 36 no.1:29-34 Ja '58. (MIRA 11:2)

1. Iz Respublikanskogo protivotuberkuleznogo dispansera Latviyskoy SSR (glavnyy vrach Ye.Ye.Kuznetsova)
(TUBERCULOSIS) (ADOLESCENCE)

GUREVICH, A.P.

LIPNITSKIY, M.Ye., inzh.; GUREVICH, A.P., inzh.

Precast reinforced concrete column bases. Rats. i izobr. predl. v stroi. no.2:4-6 '57. (MIRA 11:1)

(Columns, Concrete)

GUREVICH, A.P.

Casting thin rods in multiple channel sand molds. Lit. proizv. no.12:38 D '64. (MIRA 18:3)

[illegible]VICH, A.[illegible]

Flask bottom plates for assembling of large molds into stepped stacks. Lit. proizv. no.11:39 N '64. (MIRA 18:8)

APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000617410013-8"

SOV/112-59-2-4142

6(7)

Translation from: Referativnyy zhurnal. Elektrotekhnika, 1959, Nr 2, p 279 (USSR)

AUTHOR: Gurevich, A. S., Klement'yev, L. N., and Rozenbaum, A. M.

TITLE: Influence of Certain Changes in Design of a Single-Cord Cotton-Insulated Wire Upon Capacitive Couplings in the Quad (Vliyaniye nekotorykh izmeneniy konstruktsii odinochnoy zhily s kordel'nobumazhnoy izolyatsiyey na yemkostnyye svyazi chetverki)

PERIODICAL: Tr. N.-i. in-ta kabel'n. prom-sti, 1957, Nr 2, pp 152-157

ABSTRACT: Bibliographic entry

USCCMM-DC-60,665

Card 1/1

SOV/110-59-9-12/22

AUTHORS: Gurevich, A.S. and Vernik, S.M.
(Candidates of Technical Sciences)

TITLE: Improvements in the Construction of Symmetrical High-Frequency Cables with paper-"string" Insulation

PERIODICAL: Vestnik elektropromyshlennosti, 1959, Nr 9, pp 43-45 (USSR)

ABSTRACT: In order to increase the number of channels transmitted by cables with paper-"string" insulation it is required to extend the frequency band-width from 108 to 252 kc/s. It is, therefore, necessary to reduce the interference between circuits within the desired frequency range. Mutual interference between circuits may result either from variations occurring in manufacture or from cable design factors. The construction of quad cables may be improved by reducing the winding pitch of the "string" or by winding the "string" and the plain paper with opposite lays in the pairs on the quad. The mechanical stability of cables has been improved by reducing the "string" pitch from 7 mm to 5 mm; further reduction only increased the capacitance. Graphs showing the influence of different types of cable construction on inter-circuit capacitance and asymmetry of capacitance are plotted in

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SOV/110-59-9-12/22

Improvements in the Construction of Symmetrical High-frequency Cables with Paper-"string" Insulation

Fig 1. It will be seen that considerable improvement can be achieved by use of the two methods mentioned. The length of pitch of twisting of quads determines the amount of interference between circuits of the quad due to the lead sheath. The charges and currents induced in the sheath can have a considerable effect, approximating to that of imaginary conductors of particular size and position outside the cable. Calculation of the influence of this 'third' circuit is discussed. Its influence can be reduced by reducing the pitch of twisting of the quad. However, this is only possible within limits, and a number of cables were made up of the same construction but different pitches of twisting in order to find the best values. Tabulated results show that the least pitch of twisting for cables with "string" insulation should be about 150 mm. Tests established that altering the pitch of twisting of the quad considerably improved the cable characteristics and Fig 2 shows a graph of inter-circuit capacitance and capacitance asymmetry as function of quad twisting pitch. It was also found that the influence of

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SOV/110-59-9-12/22

Improvements in the Construction of Symmetrical High-frequency Cables with Paper-"string" Insulation

the 'third' circuit may be reduced by systematically crossing the conductors of a pair within the quads in the junction boxes when the line is made. A curve in Fig 3 shows how different methods of making connection in the junction boxes affect the characteristics of a particular cable.

There are 3 figures, 1 table and 2 Soviet references.

Card 3/3

7

SOV/43-59-19-7/14

16(1)

AUTHOR: Gurevich, A.S.

TITLE: On Degenerated Problems of the Calculus of Variations

PERIODICAL: Vestnik Leningradskogo universiteta, Seriya matematiki, mekhaniki i astronomii, 1959, Nr 19(4), pp 64-77 (USSR)

ABSTRACT: Let the function $F(x,y_1,y_2,\ldots,y_n,z_1,z_2,\ldots,z_n) \equiv F(x,y,z)$ have continuous partial derivatives of third order. Let F_u denote the partial derivative with respect to u and a prime denote the derivative with respect to x; let furthermore

$$\left|F_{y_i'y_k'}\right| = \frac{\partial(F_{y_1'},\ldots,F_{y_n'})}{\partial(y_1',\ldots,y_n')} .$$

Generalized theorem of Hilbert: If $y = \bar{y}(x)$ is an extremal of the functional

(3')
$$I(y) = \int_{x_1}^{x_2} F(x,y,y')dx$$

and if the matrix

(1.4)
$$\left\| F_{y_i'y_k'} \right\| \quad (i,k = 1,2,\ldots,n)$$

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has the rank μ in a point $x = a \in (x_1, x_2)$, then there exists an integer ν, $0 \leq \nu \leq n-\mu$ so that in a certain neighborhood of $x=a$ $(\mu+\nu)$ functions $\bar{y}_i(x)$ have continuous second derivatives.

The author considers certain specific properties of degenerated variation problems. He proposes a method for the determination of the system of equations and the boundary conditions which have to be satisfied by the extremal in the degenerated variation problem. An example is given. The author mentions G.M.Fikhtengol'ts and thanks S.V.Vallander for his interest in the present paper. There are 4 references, 2 of which are Soviet, and 2 American.

SUBMITTED: March 12, 1959

GUREVICH, A.S.; PANOV, A.A., inzh., retsenzent

[Equipment for the production of abrasive tools] Oborudovanie dlia proizvodstva abrazivnykh instrumentov. Moskva, Izd-vo "Mashinostroenie," 1964. 259 p. (MIRA 17:8)

GUREVICH, A.S., kand. tekhn. nauk; KURBATOV, N.D., kand. tekhn. nauk

Mechanical reliability of communication cables. Elektrotekhnika 35 no.11:30-32 N '64. (MIRA 18:6)

APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000617410013-8"

GUREVICH, A.S., kand. tekhn. nauk; KURBATOV, N.D., dotsent

Small-sized coaxial cable with polyethylene balloon insulation. Vest. sviazi 25 no.10:3-4 S '65. (MIRA 18:11)

1. Nachal'nik otdela kabeley svyazi Leningradskogo filiala Nauchno-issledovatel'skogo instituta kabel'noy promyshlennosti (for Gurevich). 2. Leningradskiy elektrotekhnicheskiy institut svyazi (for Kurbatov).

GUREVICH, A. V.

Physics

Mathematical Reviews
Vol. 15 No. 1
Jan. 1954
Mathematical Physics

Gurevič, A. V. On the classical theory of extended particles. Vestnik Moskov. Univ. Ser. Fiz.-Mat. Estest. Nauk 1952, no. 8, 105–109 (1952). (Russian)

This paper consists of some purely formal deductions from Blohincev's theory of extended particles [Vestnik Moskov. Univ. 1948, no. 1, 83–91; these Rev. 10, 345]. The author chooses for the "smearing function", which gives the shape of the extended charge, the special form

$$\Delta(x) = \int \left[\frac{-k_0^2}{k^2 - k_0^2}\right] \exp(ik\cdot x) d_4k,$$

where k_0 is a constant defining the reciprocal "radius" of the charge. With this choice, the electromagnetic potentials A_μ are given in terms of the source-density j_μ by the fourth-order wave-equation

$$\Box(1 - k_0^{-2}\Box)A_\mu = -4\pi j_\mu.$$

The potentials of the Bopp-Podolsky electrodynamics [F. Bopp, Ann. Physik (5) 38, 345–384 (1940); these Rev. 2, 336] satisfy the same equation. However, the author points out that the two theories are not equivalent, and in particular the finite self-energies of a charged particle are different in the two theories.

F. J. Dyson.

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9-18-54

FD-486

GUREVICH, A. V.

USSR/Nuclear Physics - Quantum electrodynamics

Card 1/1 : Pub. 146-3/18

Author : Gurevich, A. V.

Title : Quantization of fields satisfying equations with higher derivatives. I.

Periodical : Zhur. eksp. i teor. fiz., 24, 149-166, Feb 1952

Abstract : Devotes this work to problems in the quantum theory of wave fields that satisfy equations with higher derivatives. Carries out canonic quantization of fields satisfying the equations $P_n(\Box) = 4\pi\rho$, where $P_n(x)$ is an arbitrary polynomial of degree n. 9 references, including 6 foreign.

Institution : Moscow State University

Submitted : September 12, 1952

GUREVICH, A. V.

USSR/Atomic and Molecular Physics - Low Temperature Physics, D-5

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34436

Author: Gurevich, A. V.

Institution: None

Title: On the Breakdown of Superconductivity of Films in a Magnetic Field

Original Periodical: Zh. eksper. i teoret. fiziki, 1954, 27, No 2, 195-207

Abstract: The question of breakdown of superconductivity of films by a magnetic field is investigated within the framework of the V. L. Ginzburg and L. D. Landau generalized theory of superconductivity (Zh. eksper. i teoret. fiziki, 1950, 20, 1064). Corrections of the order of χ^2 were obtained for the previously obtained expressions for the critical magnetic field H_k of superconducting films. The discrepancy between experiment and theory, obtained in the work by N. V. Zavaritskiy (Dokl. AN SSSR, 1951, 78, 665; 1952, 82, 239) is eliminated.

1 of 1

GUREVICH, A.V.

Electron velocity distribution functions in an alternating eletric and a constant magnetic field. Dokl.AN SSSR 104 no.2:201-204 S '55. (MLRA 9:2)

1.Nauchno-issledovatel'skiy institut zemnogo magnetizma. Predstavleno akademikom L.D.Landau.
(Electric discharges through gases)

GUREVICH, A.V.

I-5

USSR / Radiophysics. Radio-Waves ~~Reopagation~~ Propagation

Abs Jour : Ref Zhur - Fizika, No 5, 1957, No 12530

Author : Gurevich, A.V.

Inst : Not given

Title : Concerning the Problem ofPropagation of Strong Electromagnetic Waves in a Plasma.

Orig Pub : Radiotekhn. i elektronika, 1956, 1, No 6, 704-719

Abstract : A theoretical investigation was made of the effect of "self-action" upon propagation of strong electromagnetic waves in a plasma. The self-action is connected with the fact that, under the influence of a strong alternating field E, the frequency ω changes the velocity distribution of the electrons, and consequently there is a change also in the value of the

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I-5

USSR / Radiophysics. Radio-Waves ~~Reception~~ Propagation

Card : 3/3

GUREVICH, A.V.

of the plasma electron

GUREVICH, A.V.

3. A. V. GUREVICH: On the influence of radiowaves on the properties of the ionospheric plasma (NIZMIR) p. 878

Abstract: A method is developed of solving the kinetic equations which would permit the electron-velocity-distribution function to be found in ... and direct magnetic fields. This would permit ... electron-energy, the conductivity ...

...ific limitations of the required ...

RADIOTEKHNIKA I ELEKTRONIKA, Vol 1, Nr 6, 1956, p 878

GUREVICH, A.V.

1-6

USSR / Radio Physics, Propagation of Radio Waves.

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 7314

Author : Gurevich, A.V.
Inst : Scientific Research Institute for Terrestrial Magnetism, USSR.
Title : Concerning the Effect of Radiowaves on the Properties of Plasma (Ionosphere).

Orig Pub : Zh. eksperim i teor. fiziki, 1956, 30, No 6, 1112-11124

Abstract : The author investigates the problem of the dielectric constant and conductivity of magnetoactive plasma of the ionosphere type, subjected to a strong alternating electric field of frequency ω. A method is given for calculating the distribution function of the electrons by velocities (with allowance of only the elastic collisions of electrons with the molecules and ions); the method consists of expanding the solutions of the kinetic equation in powers of a small parameter $\delta\nu/\omega$ (for rapidly varying fields), where δ is the fraction of the energy lost by the electron upon collision, and ν is the effective number of collisions.

Card : 1/2

USSR / Radio Physics. Propagation of Radio Waves.

Abs Jour : Ref Zhur - Fizika No 3, 1957, No 7314

Abstract : The zero approximation obtained for the distribution function coincides with the results obtained by other investigators (Ref Zhur - Fizika, 1956, 13134). A knowledge of this function makes it possible to calculate the mean energy of the electrons, the components of the dielectric constant tensors, and the conductivity of the plasma. General equations are derived for these quantities, and many special cases are analyzed. In addition, the author considers the possibility of using the formulas from the elementary theory (in strong and weak electric fields) for the calculations. It is shown that in the case of collisions with molecules, the use of these equations leads to a small discrepancy with the results of the kinetic theory. For the case of collisions between electrons and ions, this discrepancy, as a rule, is more substantial. Bibliography, 14 titles.

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GUREVICH, A.V.

A. V. On the effect of radio waves on the prop-

GUREVICH, A.V.

56-5-39/55

AUTHOR GUREVICH, A.V.,

TITLE A Simplification of the Equations for the Function of the Distribution of Electrons in a Plasma. (Uproshcheniye uravneniy dlya funktsii raspredeleniya elektronov v plazme -Russian)

PERIODICAL Zhurnal Eksperim.i Teoret.Fiziki, 1957, Vol 32, Nr 5, pp 1237 1238 (USSR)

ABSTRACT Starting out from the Boltzmann's kinetic equation, B.I.Davydov, Zhurn. eksp.i teor.fis., Vol 7, p.1069 (1937), derived an approximate system of equations for the function $f(\vec{r},\vec{v},t) = f_0(\vec{r},v,t) + \frac{\vec{v}}{v} f_1(\vec{r},v,t) + \chi(\vec{r},\vec{v},t)$ of electrons in a plasma situated in an electrical and in a magnetic field. This system of equations is contained in the paper under review, and the quantities occurring in this system are explained. In this context, the paper under review shows that it is possible to simplify this system of equations. For this purpose, the author of the present paper first of all investigates the case of a plasma that is homogenous with respect to time. In this case the symmetrical part of the distribution function of the electrons (f_0) can change substantially only during a time span of the order of magnitude of $1/\delta\nu$, because $\partial f_0/\partial t \leq \delta\nu f_0$. In this context, $\nu = \nu(v)$ denotes the frequency of the collisions of an electron with the molecules or ions. At the same time, the (directed) current part $\vec{f}_1$ of the distribution function undergoes a considerable change during a time of the order of magnitude $1/\nu$, because $\partial \vec{f}_1/\partial t \geq \nu f$. Consequently the function $\vec{f}_1$ changes much faster

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A Simplification of the Equations for the Function of the Distribution of Electrons in a Plasma.

than f_0 as time progresses, Therefore it is possible at the integration of the above-mentioned system of equations to neglect the dependence of the function f_0 upon t. The thus obtained solution is correct with an accuracy of, at most, including the terms of the order of magnitude 5, i.e. with the same accuracy as the system of equations mentioned in the beginning of this paper. Then the paper under review proceeds to deal with the problem of determining the distribution function of the electrons of the one of the two equations of the system of equations mentioned above. The formulae for the special case of a plasma homogeneous with respect to time, and for the special case of a plasma inhomogeneous with respect to time are given. In a Maxwell's velocity distribution of the electrons, the equations for the distribution function are reduced to the system of equations for the temperature T_e and the density n of the electrons.

(No reproduction).

ASSOCIATION Physical Institute "P.N.Lebedev", Academy of Sciences of the U.S.S.R.

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Card 2/2

06459
SOV/141-1-5-6-3/28

AUTHOR: Gurevich, A.V.

TITLE: On the Theory of the Cross-modulation of Radiowaves

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1958, Vol 1, Nr 5-6, pp 17 - 28 (USSR)

ABSTRACT: First, the depth of cross-modulation μ' in the presence of a strong perturbing wave is considered. It is assumed that at the boundary of the plasma, the perturbing wave is expressed by:

$$E_1 = E_0(1 + \mu_0 \cos \Omega t) \cos \omega_1 t \qquad (1)$$

When the wave propagates in the plasma, the effective temperature of the electrons varies periodically and the absorption of the second wave, E_2, is changed. This results in the modulation of E_2 at the frequency Ω. The depth of cross-modulation of E_2 over a distance dz can be expressed by Eq (2'). The final expression for the depth of the cross-modulation μ' is, therefore, given by

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On the Theory of the Cross-modulation of Radiowaves

Eq (3), where $\varkappa_1$ is expressed by the second equation on p 20, while τ is defined by Eq (3'). The remaining symbols are as follows: N is the electron density, n_1 is the refractory index for E_1, ν_0 is the electron collision frequency in the unperturbed plasma, T is the plasma temperature and k is the Boltzman constant. Eq (3) can be used to determine μ' as a function of the amplitude of the perturbing wave (at the boundary of the plasma). The results are shown in Figure 1, where the relative cross-modulation depth f is plotted as a function of the amplitude of the perturbing field. When the perturbing field is comparatively small, Eq (3) can be written as Eq (4). The results obtained from Eq (4) are also plotted in Figures 1 ("dashed" curves). The dependence of μ' on the power P of the perturbing station is illustrated in Figure 2. In order to investigate the increase of the cross-modulation at the gyro-frequency, it is sufficient to take into account the interaction of

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the extraordinary perturbing wave; the ordinary wave produces a negligible cross-modulation and does not lead to any resonant effects. If the perturbing wave is comparatively weak and the frequency of E_2 is higher than ν_o, the cross-modulation can be determined from (Ya. L. Al'pert et al - Ref 7):

$$\mu' = \frac{\omega_2}{c}\int_S \varkappa_2 \frac{\Delta\nu}{\nu_o} ds = \frac{\omega_2}{c}\int_S \varkappa_2 \mu_o \frac{e^2 E^2(s)}{3mkT\delta(\omega_1'^2 + \nu_o^2)} ds \qquad (6),$$

where $\Delta\nu$ is the amplitude of the periodic perturbation of the collision frequencies, $\varkappa_2$ is the absorption coefficient for E_2, $\omega_1' = \omega_1 - \omega_H$, $E(s)$ is the amplitude of the perturbing wave at a point s, ω_H is the gyro-frequency. Since the total absorption of E_2 in the ionosphere is given by Eq (7), the cross-

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On the Theory of the Cross-modulation of Radiowaves

modulation can be expressed as Eq (8). The parameter K_1^o in Eq (8) denotes the absorption of the perturbing wave up to the reflection point of the wave E_2, while the expression for $f(K_1^o)$ is given by Eq (8'). The function $f(K_1^o)$ is plotted in Figure 3 for various values of n. From Eq (8) it follows that μ' depends but little on the frequency of the perturbing wave, provided that the wave is strongly absorbed in the interaction region. The dependence of μ' on ω_1, in the vicinity of ω_H, is illustrated in Figure 5a; the curves are evaluated for the case when the frequency of E_2 is comparatively low. The phase of the cross-modulation for $\Omega \ll \delta\nu_o$ is given by the penultimate equation on p 27. Similarly, the case of the phase for $\Omega \gg \delta\nu_o$ is expressed by the last equation on p 27. These formulae were used to

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On the Theory of the Cross-modulation of Radiowaves

determine the relative phase and the results are plotted in Figure 6. The author makes acknowledgment to V.L. Ginzburg for his interest in this work. There are 6 figures and 22 references, of which 15 are English and 7 Soviet.

ASSOCIATION: Fizicheskiy institut imeni P.N. Lebedeva AN SSSR (Physics Institute im. P.N. Lebedev of the Ac.Sc.USSR)

SUBMITTED: June 20, 1957 to Radiotekhnika i elektronika, then to the editor of this journal on May 5, 1958

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06486
SOV/141-58-4-2/26

AUTHOR: Gurevich, A.V.

TITLE: On the Change of Modulation of Strong Radio Waves in a Plasma (Ionosphere) (Ob izmenenii modulyatsii sil'nykh radiovoln v plazme (ionosfere))

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1958, Nr 4, pp 21-31 (USSR)

ABSTRACT: The first part of this work was published earlier (Ref 1). The propagation of strong radio waves in a plasma is considered in an approximation which corresponds to the geometrical optics approximation in the usual theory. It is shown that the frequency spectrum of the modulated incident wave is distorted. These distortions are small, provided $\omega \gg \delta\nu$, where δ is the mean fraction of energy lost by electrons per collision and ν is the frequency of collisions. In this case the amplitude of the harmonics is small compared with the amplitude of the fundamental wave. In the E-layer of the ionosphere the condition $\omega \gg \delta\nu$ is well obeyed for radio waves whose frequency is greater than 1 kc/s, while in the D-layer the frequencies must be greater than 50 kc/s. For the F-layer this lower frequency limit is 1 c/s while in the

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solar corona it is 0.1 c/s. The absorption of a strong wave in the plasma may be quite different from absorption of a weak wave. For very strong radio waves whose amplitude is much greater than the "plasma field" ($E_o \gg E_n$) the usual concept of absorption loses its meaning altogether. For such waves two effects can take place. They either freely pass through the plasma without experiencing any absorption (independently of the degree of absorption experienced by a weak wave of the same frequency) or they are fully absorbed in the plasma (in the latter case the wave always becomes weak after passage through a plasma layer and amplitude of the resultant weak wave is determined only by the plasma field and does not depend on the amplitude of the incident wave). The first case occurs for high-frequency waves when $\omega \gg \nu$ in a strongly ionised plasma and for low-frequency waves when $\omega \ll \nu$ in a weakly ionised plasma. The second effect occurs for $\omega \gg \nu$ in a weakly ionised plasma. Non-linear properties of the ionosphere are most pronounced in the

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On the Change of Modulation of Strong Radio Waves in a Plasma (Ionosphere)

lower part of the E-layer for waves whose frequency is $f \lesssim 500$ kc/s. However, for waves with $W \approx 500-1000$ kW the above limiting cases are not in fact realised since the E_0 of the incident wave is of the same order as E_n. In order to take into account changes in the absorption of such waves a special coefficient P was introduced earlier (Ref 1), to describe changes in the amplitude. Table 1 gives the values of this coefficient for different frequencies and powers. Analysis of these data shows that, for example, when a transmitter working on 500 kc/s alters its power from 1000 to 5000 kW the amplitude of the wave reflected from the ionosphere increases by a factor of 1.44, while in the case of a weak wave such an increase in the amplitude could be obtained by increasing the power by a factor of only 2 and not 5. The phase of the wave is not affected very much. Phase changes are most pronounced for waves whose frequency is nearly equal to the effective electron collision frequency. It is shown that the modulation amplitude of the wave can change very considerably.

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On the Change of Modulation of Strong Radio Waves in a Plasma (Ionosphere)

If $E_o \gg E_n$ the wave is either completely demodulated on passing through a plasma layer or the depth of its modulation is increased. The first case occurs in a weakly ionised plasma for high-frequency waves and the second for low-frequency waves. The changes in the modulation depth occur only at low modulation frequencies ($\lesssim \delta \nu$); at higher frequencies they are negligible. An estimate is also made of the phase modulation of strong waves in a plasma. There are 8 figures, 1 table and 13 references, 6 of which are Soviet, 4 Italian and 3 English.

ASSOCIATION: Fizicheskiy institut im P.N.Lebedeva, AN SSSR (Physical Institute imeni P.N.Lebedev, AS USSR)

SUBMITTED: 5th May 1958

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GUREVICH, A.V.

Temperature of electrons in plasma in an alternating electric field [with summary in English]. Zhur. eksp. i teor. fiz. 35 no.2:392-400 Ag '58. (MIRA 11:10)

1. Fizicheskiy institut im. P.N. Lebedeva AN SSSR.
(Electrical discharges through gases)
(Electric fields)

67526

SOV/141-2-3-3/26

9,9100

AUTHOR: Gurevich, A.V.

TITLE: The Effect of an Electric Field on the Electron Velocity Distribution in Molecular Plasma (Ionosphere)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1959, Vol 2, Nr 3, pp 355 - 369 (USSR)

ABSTRACT: In molecular gases such as hydrogen, oxygen and nitrogen, inelastic collisions predominate already at energies of 0.01 eV (i.e. at room temperature). Moreover, there is not enough information at the present time on inelastic cross-sections for collisions between slow electrons and molecules (Ref 2) and hence the problem of the electron-velocity distribution in molecular plasma has not been solved. The mean electron energy and the current in molecular plasma are usually calculated with the aid of a simplified kinetic theory in which the velocity distribution of the plasma electrons is not taken into account. It follows that the results obtained are only approximate and the problem arises of how approximate these results actually are. The problem can only be solved by rigorous application of the kinetic theory. This is done in the

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The Effect of an Electric Field on the Electron Velocity Distribution in Molecular Plasma (Ionosphere)

present paper. In the first section, it is shown that using the properties of a molecular plasma the kinetic equation (analogous to that normally used for purely elastic collisions) can be considerably simplified. The collision integral (for inelastic collisions in molecular plasma) is found to be of the form given by Eq (8b), where $Q_H(v)$ is the fraction of energy lost per unit time by an electron due to inelastic collisions. This relation holds for energies $\lesssim$ 1 eV. In the next two sections a solution is obtained of the kinetic equation and the solution is analysed in the case of hydrogen, oxygen and nitrogen. It is shown that the effective frequency of collisions and the electron current in the case of a high degree of ionisation are given by Eq (11a) and the average fraction of energy lost by an electron per collision is given by Eq (11b). Figure 1 shows a plot of the calculated values of the latter quantity as a function of temperature. Experimental points are also indicated. The agreement between

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theory and experiment is shown to be good. A similar calculation is carried out for the case of a low degree of ionization and the average energy loss is calculated for hydrogen, oxygen, nitrogen and air. The result is shown in Figure 2. The final section is concerned with the accuracy of the formulae obtained with the aid of the simplified kinetic theory and the limits of their applicability. It is shown that in the case of hydrogen, oxygen, nitrogen and air the simplified kinetic theory may be used for low electron energies without an appreciable error in order to calculate the mean electron energy and current. Kinetic corrections become important at low frequencies, i.e. frequencies smaller than the effective collision frequency. Acknowledgment is made to V.L. Ginzburg for his interest in this work.
There are 5 figures and 18 references, 9 of which are Soviet (1 is a translation from English), 1 German, 2 international and 6 English.

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The Effect of an Electric Field on the Electron Velocity Distribution in Molecular Plasma (Ionosphere)

ASSOCIATION: Fizicheskiy institut im. Lebedeva (Physics Institute im. Lebedev)

SUBMITTED: December 25, 1958

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21(7), 9(3) SOV/56-36-2-47/63

AUTHOR: Gurevich, A. V.

TITLE: The Unsteadiness and the Hysteresis of the Electron Temperature in a Plasma in Inert Gases (Nestatsionarnost' i gisterezis elektronnoy temperatury v plazme v inertnykh gazakh)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 2, pp 624-626 (USSR)

ABSTRACT: In one of his previous papers (Ref 1), the author discussed some special features of the heating of an electron gas in a heavily ionized plasma. These features are caused by the fact that the frequency of the collisions of the electrons with the ions sharply decreases if the electron velocity increases. Analogous effects occur also in a weakly ionized plasma; it is only necessary that the collision frequency of the electron sufficiently sharply decreases with the increase of electron velocity: $\nu \sim v^{-\alpha}$ where $\alpha > 1$. This condition is not satisfied in the general case since the frequency of the electron-molecule collisions usually increases with increasing v. Also the inverse dependence is, however, possible. This occurs, for exam-

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ple, in the heavy inert gases argon, crypton, xenon at low electron velocities $v \lesssim 5 \cdot 10^7$ cm/sec (Ramsauer (Ramzauer) effect). For a weakly ionized plasma, the steady electron temperature T_e is calculated in the same manner as for a highly ionized plasma and the found dependence of T_e on the field strength of the electric field in crypton (at 27°C) is given in a figure. According to this figure, the weakly heated state of the electron gas becomes insteady at a certain value of the field strength (as in the case of a highly ionized plasma). In the case investigated in the present paper, however, there is also a second stable state at high electron temperatures; it is caused by the increase of the frequency of the collisions of the electron with the crypton atoms at high velocities ($v > 5 \cdot 10^7$ cm/sec). The critical values of the field strength for transitions from the first into the second state and inversely are only slightly different. The hysteresis loop, therefore, includes only a small area. The electron temperature varies 3 times in these

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transitions, and therefore also electron conductivity varies. The calculations discussed in this paper are valid only in the case in which the electrons have a Maxwell (Maksvell) velocity distribution. There are 1 figure and 4 references, 2 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: October 23, 1958

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24 (5) SOV/56-37-1-50/64

AUTHOR: Gurevich, A. V.

TITLE: The Influence of Collisions Between Electrons on Their Velocity Distribution in Gases and in Semiconductors in the Electric Field (Vliyaniye soudareniy mezhdu elektronami na ikh raspredeleniye po skorostyam v gazakh i v poluprovodnikakh v elektricheskom pole)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 1, pp 304 - 306 (USSR)

ABSTRACT: In a plasma, which is located in an electric field, the velocity distribution function of electrons depends only on the velocity modulus and is symmetric. In the case of a very low ionisation of the plasma, its shape is influenced only by the collisions between electrons and heavy particles, but with higher ionisation, collisions among electrons play an important part; this leads to an approximation of the distribution function to the Maxwell form. The author of the present "Letter to the Editor" briefly investigates the influence of collisions of electrons among themselves upon the form of the distribution function. By using the results obtained by Landau (Ref 4) and by taking the symmetry of the main part of the distribution function into

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The Influence of Collisions Between Electrons on Their Velocity Distribution in Gases and in Semiconductors in the Electric Field SOV/56-37-1-50/64

account, the integral of the collisions S_{ee} of the electrons is set up in the following manner:

$$S_{ee}(f_o,f_o) = -\frac{1}{v^2}\frac{\partial}{\partial v}\left\{v^2\nu_{ee}\left[A_1(f_o)\frac{\partial f_o}{\partial v} + A_2(f_o)vf_o\right]\right\}$$

ν_{ee} denotes the collision frequency of the electrons (explicitly written down in formula (1')), and also the coefficients A_1 and A_2 are explicitly given. In the following, a parameter p, which characterizes the influence of collisions among electrons upon the distribution function, is defined: $p = \frac{12\pi e^2 N_e}{le^2}\ln\left(\frac{k^{3/2}T_eT^{1/2}}{e^3 N_e^{1/2}}\right)$;

e is the electron charge, N_e and T_e denote the density and temperature of the electrons, T - the temperature of the heavy particles. For strong constant electric fields E, the distribution

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may in first approximation $(f_o^{(1)})$ be given by formula (3). For high u-values $(u = mv^2/2kT_e)$ $f_o^{(1)}$ actually coincides with $f_o^{(2)}$, and for not too high p-values the distribution may approximately be represented by

$$f_o = C \exp\left\{-\frac{u^2}{4} + \frac{pu}{4} - \frac{p(p+4)}{8} \ln\left(1 + \frac{2u}{p}\right)\right\}$$

In a diagram the figure shows the dependence of $\ln(f_o^{(1)}/C)$ on u for various p-values. For high p-values the curve approaches Maxwell's straight line, and for p = 0.1 it practically coincides with Druyvestein's parabola (Ref 8). The author finally thanks V. L. Ginzburg, L. V. Keldysh and L. M. Kovrizhnykh for discussions, and L. V. Pariyskaya for carrying out numerical computations. There are 1 figure and 8 references, 4 of which are Soviet.

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The Influence of Collisions Between Electrons on Their Velocity Distribution in Gases and in Semiconductors in the Electric Field SOV/56-37-1-50/64

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: March 4, 1959

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30522
S/194/61/000/008/082/092
D201/D304

3,2600 (1538,1502)

AUTHOR: Gurevich, A.V.

TITLE: Perturbances in the ionosphere caused by a moving body

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 8, 1961, 68, abstract 8 I469 (Tr. In-ta zemn. magn. ionosfery i rasprostr. radiovoln. AN SSSR, 1960, no. 17 (27), 173-186)

TEXT: In the survey of the ionosphere, the rockets and satellites themselves produce perturbances by changing in the vicinity of their surface of gas density, ion or electron concentration, the electric field and temperature. It may be possible that the above perturbances account for the experimentally observed strong dispersion of radiowaves transmitted from earth in the vicinity of a satellite. The motion of bodies in upper ionosphere layers is characterized by two peculiar effects. The motion is inside a

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strongly rarified gas, with lengths of particle trajectories much exceeding the dimensions of the body. Thus a correction must be introduced into the kinetic theory accounting for the new gas structure which has to be taken as an aggregate of independent molecules. On the other hand, since the motion is inside an ionized gas-plasma, it is necessary to take into account the interaction between the body and electrons and ions. This leads to a difference in the ion and electron perturbances, the upsetting of the quasi-linearity of plasma and appearance of an electric field. The changes in the concentration of neutral particles in the vicinity of the moving body have been evaluated by the methods of the generalized kinetic theory of gases, using the kinetic equation in a differential form. The problem has also been solved of concentrating electrons and ions, and the magnitude of the electric field has been determined. In conclusion the problem is analyzed of the possibility of excitation of longitudinal waves in plasma by the stream of ions reflected from the body. In the solution of the above problems the assumption is made that the following relationship is satisfied

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$$\sqrt{\frac{kT}{M}} << v_0 << \sqrt{\frac{kT}{m}},$$

where k - Boltzmann's constant, T - absolute temperature in $^{\circ}$K; M - molecule mass; m - electron mass; v_0 - the velocity of body in the ionosphere $\sim$ 10 km/sec. Cases when $v_0 \leq \sqrt{\frac{kT}{M}}$ (order of 1 km/sec), are not considered. In front of bodies a region of concentration of molecules is obtained. The relative increase in density is 1.02-2. In the wake of the body there is a corresponding region with decreased relative density equal to 0 in the vicinity of the body, and increasing to 0.9 at a distance equal to 24.5 body radii. [Abstracter's note: Complete translation]

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GUREVICH, A.V.

Certain characteristics of ohmic heating of electron gas in a plasma. Zhur. eksp. i teor. fiz. 38 no.1:116-121 Jan '60. (MIRA 14:9)

1. Fizicheskiy institut im. P.N.Lebedeva AN SSSR.
(Electron gas) (Plasma (Ionized gases))

83603

9.9130
21.2330

S/056/60/038/005/036/050
B006/B063

AUTHOR: Gurevich, A. V.

TITLE: The Problem of the Amount of Accelerated Particles in an Ionized Gas Under Various Accelerating Mechanisms 19

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 5, pp. 1597-1607

TEXT: As a contribution to investigations on the origin of cosmic rays and solar corpuscular radiation, the present paper describes an analysis of accelerating mechanisms in ionized gas. The author first considers Fermi's statistical accelerating mechanism, in which the ion energy grows on account of collisions with clouds of charged particles. If the mean free path L of the ion between two collisions is constant and independent of the ion energy ε, the ion receives the energy $2/3Mv_{cl}^2$ in each collision (M - ion mass, v_{cl} - mean velocity of the cloud). A comparison between the energy obtained and the energy transferred by interaction with other ions gives the relation $\varepsilon < \varepsilon_{in} = 3\nu_o L(kT)^{3/2}/2\sqrt{2}\, v_{cl}^2 M^{1/2}$ for the condition that the ion energy tends toward a steady value. If $\varepsilon > \varepsilon_{in}$, it grows

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continuously in time. ε_{in} is usually designated as injection energy. If $\varepsilon_{in} \sim kT$, all particles are accelerated simultaneously. If $\varepsilon_{in} \gg kT$, only the (small) part is accelerated at first, whose energy is sufficiently high ($\varepsilon > \varepsilon_{in} \gg kT$). This is the so-called weak mechanism which is studied in this work. If $\varepsilon > \varepsilon_{in}$, the particle energy grows in time, and during Δt about $\Delta N \sim \nu \Delta t N(\varepsilon_{in})$ particles leave the equilibrium region. $N(\varepsilon_{in})$ denotes the number of particles having an energy between ε_{in} - kT and ε_{in}. In the case of Maxwellian distribution, $\Delta N \sim \nu \Delta t N_o \exp(-\varepsilon_{in}/kT)$. ($\nu(\varepsilon)$ denotes the collision frequency; $\nu(\varepsilon) = \nu_o (kT/\varepsilon)^{3/2}$). It is found that the character of the velocity distribution in the range $\varepsilon \sim \varepsilon_{in}$ is changed by the weak acceleration mechanism to such an extent that these relations are unsuited for estimating the number of particles leaving the region. (These particles are called "accelerated particles"). The amount of accelerated particles is one of the principal characteristics of the weak mechanism. The determination of the flux of these accelerated particles as a function of the parameters

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involved was the principal aim of the author's investigations. First, he gives some relations for a system of similar particles being in Coulomb interaction and which are influenced by the weak statistical accelerating mechanism. These relations include the equation of motion whose steady-state solution is treated in the following section of the present paper. Furthermore, the author considers the stabilized quasisteady solution, and derives a general solution for the flux of the accelerated particles. The distribution function is also given in a general form. Finally, the author specializes the flux formula for ion acceleration in a plasma by Fermi's statistical accelerating mechanism and obtains formula (24). If v^2_{c1} is independent of the parameters of the plasma, the flux drops exponentially with increasing plasma density and increases with the temperature of the plasma. The flux of the accelerated ions increases also rapidly with an increase in the ion mass. The author thanks V. L. Ginzburg for his interest in this work, and S. I. Syrovatskiy for his valuable advice. There are 1 table and 2 non-Soviet references.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: December 21, 1959

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86902

10.8000
26.2311
24.2120 (1144, 1164)

S/056/60/039/005/019/051
B006/B077

AUTHOR: Gurevich, A. V.

TITLE: Theory of the Effect of the Runaway Electrons

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 5(11), pp. 1296-1307

TEXT: In a plasma the collision frequency of an electron with an ion and other electrons decreases rapidly with increasing velocity, and, therefore, the friction of the electrons with a sufficiently high energy is negligibly small. If the plasma is in a constant electrical field, the velocity of these electrons called "runaway electrons" will increase continuously with time. Very strong fields will accelerate all electrons and they all enter the category of the "runaway electrons", but in a weak field this will hold only for such with $v > v_{crit}$. In weak fields $v_{crit} \gg v_{therm}$ of the electrons in the plasma. In order to determine v_{crit} it is necessary to know the distribution of velocity of the electrons at $v \sim v_{crit}$, this calculation being a very complicated problem if the

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B006/B077

collisions are taken into account. The aim of the present paper was to examine the effect of a relatively weak field upon the distribution of velocity of the electrons in a plasma at high velocities. The authors derive and analyze expressions for the steady distribution function and the flow of the "runaway electrons" in a completely ionized plasma. The plasma is assumed to be unbounded and completely ionized, the electron velocity to be $v \gg \sqrt{kT_e/m}$, and the $\vec{E}$-field to be homogeneous and constant. For the case of a weakly ionized plasma the effect of the neutral particles upon the flow of the "runaway electrons" is examined and an analysis of the degree of ionization performed. The instabilities arising in a spatially homogeneous plasma are also studied. It is shown that under certain conditions plasma instabilities may occur during the development of the discharge due to the runaway electron flux. The results obtained agree in quality with experimental results. The author thanks V.L.Ginzburg and V. P. Silin for discussions. L. M. Kovrizhnykh is mentioned. There are 11 references: 8 Soviet and 3 US.

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86902

Theory of the Effect of the Runaway Electrons

S/056/60/039/005/019/051
B006/B077

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: May 23, 1960

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68696

24.2120

AUTHORS: Ginzburg, V. L., Gurevich, A. V. S/053/60/070/02/004/016 B006/B007

TITLE: Nonlinear Phenomena in a Plasma Which Is Located in a Variable Electromagnetic Field 21

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol 70, Nr 2, pp 201-246 (USSR)

ABSTRACT: The present paper is the first part of a very detailed survey of the theory of nonlinear phenomena in an ionized gas. This article will be published simultaneously in the periodical "Fortschritte der Physik" of Eastern Germany. The nonlinearities occurring partly because of the relatively great electron free path and partly because of the considerable difference between electron mass and atomic- and molecular masses already at comparatively low field strengths (e.g. if the polarization and the conduction current are not proportional to the field $\vec{E}$, the propagation of electromagnetic waves must be described by a nonlinear theory, as the superposition principle, for example, no longer holds), are systematically dealt with with reference to voluminous publications. In the first two paragraphs of the present article, the influence exerted by a homogeneous electric field

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S/053/60/070/02/004/016
B006/B007

$\vec{E} = \vec{E}_0 e^{i\omega t}$ upon a non-relativistic and non-degenerate (classical) plasma which may be located in a homogeneous and constant (external)magnetic field $\vec{H}_0$ is investigated. Macroscopic (hydrodynamic) motions in the plasma are not dealt with. The influence of the field upon the plasma in this case leads to a change in the velocity-distribution function of the plasma electrons, which is set up as a function of ω, $\vec{E}_0$, $\vec{H}_0$ and of the plasma parameters. The distribution function of the heavy particles may in this case be considered to be a Maxwell temperature function, which is justifiable in the steady case under investigation. If the electron velocity distribution is known, their kinetic energy (their temperature T_e) and the total current density $\vec{j}_t$ may be determined. In weak fields electron temperature is equal to that of the heavy particles, and $\vec{j}_t$ is proportional to $\vec{E}$. Paragraph 1 deals with the elementary theory of the plasma in a homogeneous electric field (electron current; dielectric constant and plasma conductivity; electron temperature). In paragraph 2 the kinetic theory of a

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B006/B007

plasma in a homogeneous electric field, i.e. the description of the electron gas by means of distribution functions $f(\vec{v},\vec{r},t)$ is dealt with. Individual sections deal with the following: The kinetic equation; the transformation of the collision integral; elastic collisions with neutral particles (molecules); inelastic collisions with neutral particles; collisions with ions; collisions of electrons with one another; the solution of the equation of motion for a highly ionized plasma; the (Maxwellian) distribution function; the effective number of collisions; the relative portion of transferred energy δ_{eff} (table 1 gives the δ_{eff}-values for electron temperatures of between 500 and 15000° for helium, hydrogen, oxygen, nitrogen, and air; δ_{eff} equals δ_{elast} up to electron temperatures of ~ 1 ev, after which it increases exponentially with T_e.); electron current, dielectric constant and conductivity of the plasma; electron temperature; the weakly ionized plasma; elastic collisions; the molecular plasma; inert gases; the electron current and the mean energy of the electrons; the elementary theory

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B006/B007

for an arbitrary degree of ionization; transition from the highly- to the weakly ionized plasma; and the conditions for the applicability of the elementary theory (by comparison with the kinetic theory these conditions are mathematically formulated for highly and weakly ionized plasma). There are 8 figures, 2 tables, and 68 references, 35 of which are Soviet.

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AUTHORS: Ginzburg, V. L., Gurevich, A. V.

S/053/60/070/03/001/007
B006/B014

TITLE: Nonlinear Phenomena in a Plasma Located in a Variable Electromagnetic Field

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol 70, Nr 3, pp 393-428 (USSR)

ABSTRACT: This article is continued from a survey published in "Uspekhi fizicheskikh nauk", 1960, Vol 70, p 202. Paragraph 3 deals with the nonlinear effects occurring in the propagation of radio waves in a plasma (ionosphere, solar corona), perturbation of the principle of superposition, influence of the wave field on the plasma, Maxwell equations. Section 3.1 deals with the propagation of radio waves in a plasma in consideration of nonlinearity (self-action of the radio waves). In this case, the field at the plasma boundary (z=0 plane) is assumed to be $\vec{E}_0(0) \cos \omega t$, and the wave propagation is described by $\Delta\vec{E} - \text{grad div}\,\vec{E} + \frac{\omega^2}{c^2}\varepsilon'(\vec{r},\omega,E_0)\vec{E} = 0$; $\varepsilon' = \varepsilon - \frac{4\pi\sigma i}{\omega}$.
The amplitude and the self-action factor are studied, and the modulation of waves is discussed in detail. Section 3.2

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describes the influence of self-action on the propagation of radio waves in the ionosphere. This self-action depends on the wavelength, and is separately studied for short waves, medium waves (Table 4), and long waves. The resonance of self-modulation near the gyromagnetic frequency, which amounts to $(6 - 8) \cdot 10^6$ in the ionosphere, is also investigated. The specific features and the causes of this greatly nonlinear effect are discussed separately. Section 3.3 is devoted to an investigation of the interaction between modulated radio waves (cross modulation). A theoretical study of cross modulation in an isotropic plasma is followed by an investigation of the influence of a constant magnetic field and of the resonance effects occurring near the gyromagnetic frequency. Section 3.4 describes the results of experiments on cross modulation in the ionosphere (absolute cross-modulation depth, dependence of the depth μ_Ω and the phase of cross modulation on the depth μ_0 and the frequency Ω, dependence of μ_Ω on the intensity and frequencies of the disturbing waves, and cross-modulation

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resonance). In section 3.5 the authors study the nonlinear interaction of nonmodulated radio waves. At first, the variations of propagation conditions for a nonmodulated wave are investigated, then so-called lateral waves, viz. waves with combined frequencies, and finally the nonlinear effects connected with the variation in electron concentration. This article is concluded with a few notes about future studies in this field. There are 11 figures, 2 tables, and 65 references, 21 of which are Soviet.

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AUTHOR: Gurevich, A.V.

TITLE: Disturbances Produced in the Ionosphere by a Moving Body

PERIODICAL: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli, No. 7, Moscow, 1961, pp. 101 - 124

TEXT: The particular feature of the motion of a body such as a rocket or satellite through the upper ionosphere is that the motion takes place in a very rarefied medium. The mean free path of the particles in this medium is very much greater than the linear dimensions of the moving body. It follows that one cannot use the usual hydrodynamic methods and the medium cannot be looked upon as continuous. The interaction of the body with the medium must be described in terms of the kinetic theory, taking into account the interaction of the body with the ions and electrons in the medium. Since the interaction of the body with the ions and electrons is not the same, the quasi-neutrality of the plasma is upset and the electric field appears. The present paper is concerned with

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estimates of such disturbances in the ionosphere. The first section gives a calculation of the changes in the concentration of neutral particles in the neighbourhood of the moving body, the second section gives an analogous calculation for the electrons and ions, including the electric-field effects, while the third section gives the solution of the problem with allowance for the (constant) Earth's magnetic field. It is assumed throughout that the velocity of the body is much greater than the thermal velocity of the molecules or ions and much smaller than the thermal velocity of the electrons. In order to simplify the problem, the moving body is assumed to be spherical in form. It is clear that two regions can be distinguished, namely, the region in front of the moving body, where the density is increased and the region behind the body where the density is reduced. These will be referred to as the "front" and "rear" regions. Two cases can then be distinguished, namely: 1) elastic reflection from the moving body and 2) diffuse reflection (equal probability of reflection in all directions). Formulae are derived for the two cases and

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Fig. 2 shows a graphical representation of these results for the front region. The first plot in Fig. 2 shows the situation for the case of elastic reflection and the second plot gives the results for the diffuse reflection (R_o is the radius of the body). These calculations are carried out on the assumption that the particle reached the surface of the body with a certain average velocity v_o which is representative of the appropriate Maxwellian distribution. The results in Fig. 2 are given in the frame of reference attached to the moving body. The rear region differs in that the incident molecules can no longer be looked upon as having a certain average velocity v_o and the velocity distribution must be taken into account. This distribution is assumed to be Maxwellian. For a spherical body the density-distribution is shown graphically in Fig. 3. Calculation of the ion and electron densities and of the electric field is said to be much more difficult. The solution involves the transport equations for the ions and electrons as well as the field equation. In the first part of this

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section, it is assumed that all the charged particles are reflected from the surface of the body although even with this assumption the general solution is very complicated. Since the velocity of the body is very much smaller than the average thermal velocity of the electrons, the electron velocity-distribution can be assumed to be of the form

$$f_e(r, v) = n_{e0}\left(\frac{m}{2\pi kT}\right)^{3/2} \exp\left\{-\frac{\frac{mv^2}{2} + e\varphi + U}{kT}\right\}. \tag{14}$$

and hence the electron density is given by:

$$n_e(r) = n_{e0} \exp\left\{-\frac{e\varphi + U}{kT}\right\}. \tag{15}$$

where φ is the electric-field potential and
U is the energy of interaction of the particles with the surface of the body.

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Consideration of the analogous problem for the ions has led to a solution which is illustrated graphically in Fig. 4. This figure shows the equipotential surfaces in the neighbourhood of a spherical body reflecting all the particles incident upon it in the case where $v_0/v_T = 8$ $(v_T = \sqrt{2kT/M})$. The quantity A shown in this figure is defined by

$$A = 2.1 \times 10^{2} n_{e0} R_0^2 \qquad (16b)$$

Fig. 5 shows the corresponding plot for the case where the surface of the spherical body (metal) absorbs all the particles incident upon it. The final section is concerned with the effects of the magnetic field. It is shown that the magnetic field has little effect on the electron concentration and the electric-field potential and hence it is only necessary to consider the ion concentration. Maxwellian distribution is again assumed and expressions are derived for the ion-density change. Acknowledgments are expressed to

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Ya.L. Al'pert and L.P. [illegible]tayevskiy for discussions. There are 10 figures, 5 tables and 4 references: 1 Soviet and 3 non-Soviet. The two English-language references quoted are: Ref. 1 - I.D. Kraus [illegible] 46 [illegible] 1958 and C.R. Roberts, P.H. Kirchner [illegible] Proc. I.R.E., 47, 1156, 1959.

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GUREVICH, A.V.; TSEDILINA, Ye.Ye.

Effect of a constant electric field on electron temperature in the ionosphere. Geomag. i aer. 1 no.1:34-40 Ja-F '61. (MIRA 14:7)

1. Fizicheskiy institut AN SSSR imeni P.N. Lebedeva i Institut zemnogo magnetizma, ionosfery i rasprostraneniya radiovoln AN SSSR.

(Ionosphere) (Electrons) (Electric fields)

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AUTHOR: Gurevich, A. V.

TITLE: Peculiarities of the behavior of multiply charged ions in a plasma

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 6, 1961, 1825-1831

TEXT: It is shown that, under certain conditions, multiply charged ions in a singly ionized plasma under the action of a constant electric field move opposite to the ordinary singly charged ions. The motion of an ion with a charge eZ in a completely ionized plasma is described by the equation $M d\vec{v}/dt = eZ\vec{E} - \vec{F}_e - \vec{F}_i$ (1), where $\vec{F}_e$ and $\vec{F}_i$ are frictional forces due to the presence of electrons and ions, respectively. Introducing the expressions for the frictional forces into Eq. (1), one obtains $M d\vec{v}/dt = - eZ(Z - 1)\vec{E} - m\nu_{e0}\vec{Z}^2\vec{v}\left[1 + \gamma/(1 + v/v_{Ti})^3)\right]$ (1a), where ν_{e0}

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is the effective frequency of collisions of electrons with singly charged ions in a constant electric field; the parameter γ, given by $\gamma = (M_0 T_e^3/mT_{i0}^3)^{1/2}$, is generally very great; e.g., at $T_{i0} = T_e$, $\gamma \approx 60.8$ in deuterium, and $\gamma \approx 43$ in hydrogen. M_0, T_{i0}, and v_{Ti} are, respectively, the mass, temperature, and thermal velocity of ions in the plasma. The solution of Eq. (1a) shows that the velocity of multiply charged ions, v, has two stable values in a constant electric field in the range $3\gamma^{1/3} m\nu_{e0} v_{Ti} Z/2^{2/3} e(Z-1) \leqslant E \leqslant 2^{2/3}\gamma m \nu_{e0} v_{Ti} Z/3e(Z-1)$ (5). In the first steady state, the velocity is low and determined chiefly by the interaction with plasma ions (by the force $\vec{F}_i$). In the second steady state, the velocity of multiply charged ions is very high ($v_2 \approx v_0(Z-1)/Z$) and mainly determined by the interaction with electrons. The energy of multiply charged ions in the second steady state is very high and exceeds the thermal energy of electrons and ions of a singly charged plasma by one

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to three orders of magnitude. The velocity of multiply charged ions (with respect to a fixed observer) is equal to $\vec{v} + \vec{v}_{i0}$ ($\vec{v}_{i0}$ - mean velocity of singly charged ions). $\vec{v}$ always goes in the direction of electron motion, and $\vec{v}_{i0}$ in the opposite direction, so that a multiply charged ion may move in either direction, depending on the ratio of the velocities v and v_{i0}. Due to the velocity distribution of the particles, some of the ions will be in one steady state, while others are in the other steady state. The kinetic equation for the velocity-distribution function $f(\vec{v},t)$ of ions with a charge eZ in a completely ionized plasma has the form

$$\frac{\partial f}{\partial t} - \frac{eZ(Z-1)E}{M}\left(\cos\theta\frac{\partial f}{\partial v} - \frac{\sin\theta}{v}\frac{\partial f}{\partial\theta}\right) - \frac{1}{v^2}\frac{\partial}{\partial v}\left\{v^2\left[\frac{M}{M_0}\nu_i(v)\times G\left(\frac{v}{(2kT_{i0}/M_0)^{1/2}}\right)\left(\frac{kT_{i0}}{M}\frac{\partial f}{\partial v}+vf\right)+\frac{m}{M}\nu_{e0}Z^2\left(\frac{kT_e}{M}\frac{\partial f}{\partial v}+vf\right)\right]\right\} - \frac{\nu_i(v)}{2\sin\theta}H\left(\frac{v}{(2kT_{i0}/M_0)^{1/2}}\right)\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial f}{\partial\theta}\right)=0. \qquad (6)$$

Θ denotes the angle between $\vec{E}$ and $\vec{v}$; $\nu_i(v) = 4\pi e^4 NZ^2 \ln\Lambda / M^2 v^3$ stands for the frequency of collisions between multiply and singly charged ions; $G(x)$ and $H(x)$ are functions introduced by S. Chandrasechar (Ref. 5: Revs. Mod. Phys., 15, 1, 1943): $G(x) = \Phi(x) - 2xe^{-x^2}/\sqrt{\pi}$, $H(x) = (1 - \frac{1}{2}x^{-2})\Phi(x) + e^{-x^2}/\sqrt{\pi x}$; $\Phi(x)$ is the probability integral. By solving Eq. (6), the author obtains the following ratio of the number of multiply charged ions in the second state to that of ions in the first state (in the case of equilibrium):

$$\frac{N_2}{N_1} \approx \exp\left\{-\int_{v_1}^{v_2} \frac{M\nu_i(v)\,Gv/M_0 + m\nu_{e0}Z^2 v/M - eZ(Z-1)E/M}{\nu_i(v)\,GkT_{i0}/M_0 + \nu_{e0}Z^2 kT_e m/M^2}\,dv\right\}. \quad (12)$$

The author thanks V. L. Ginzburg and M. A. Leontovich for valuable discussions. There are 3 figures and 8 references: 5 Soviet-bloc and 3 non-Soviet-bloc.

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ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: January 11, 1961

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GUREVICH, A. V., PITAYEVSKY, L. P., ALPERT, Ya. L.

"On Effects Produced by a Body Moving Fast in Plasma"

Soviet Papers Presented at Plenary Meetings of Committee on Space Research (COSPAR) and Third International Space Science Symposium, Washingtion, D. C., 23 Apr - 9 May 62.

Chemistry

SKVORTSOVA, N.I.; BRENCH, T.A., BABUSHKINA, M.P., GUREVICH, A.V.

Preparation of methylgeranyl chloride. Trudy VNIISNDV no.6:
17-19 '63. (MIRA 17:4)

S/203/63/003/002/001/027
D207/D307

AUTHOR: Gurevich, A.V.

TITLE: The distribution of particles in a centrally symmetric field

PERIODICAL: Geomagnetizm i aeronomiya, v. 3, no. 2, 1963, 185-203

TEXT: Expressions for the density and flow of particles in a rarefied gas subjected to a centrally symmetric field of a body are derived and analyzed. The problem is of considerable interest in astrophysics and plasma physics, especially in the case of an attractive field. The transport equation is solved neglecting collisions for the following cases: (1) Infinite orbits in an attracting field with potential U varying as $1/r^2$; (2) Infinite orbits in an attracting field where U varies first more slowly than $1/r^2$ and then more rapidly than $1/r^2$; (3) U varying first more slowly than $1/r^2$, then more rapidly, and for large r exactly as $1/r^2$; (4) Repulsion field U > 0. The distribution of particles with finite orbits B

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also discussed. In each case the effect of absorption of the gas particles by the body is considered. Acknowledgements are made to Ya.L. Al'pert and L.P. Pitayevskiy for useful discussions. There are 9 figures.

ASSOCIATION: Fizicheskiy institut im. P.N. Lebedeva AN SSSR (Physics Institute im. P.N. Lebedev, AS USSR)

SUBMITTED: October 18, 1962

GUREVICH, A.V.; PITAYEVSKIY, L.P.

Diffusion approximation of disturbances around a body moving in a plasma. Geomag. i aer. 3 no.5:823-829 S-O '63. (MIRA 16:11)

1. Fizicheskiy institut imeni P.N.Lebedeva AN SSSR i Institut fizicheskikh problem AN SSSR.